

NICARAGUA ARAP Agriculture Reconstruction Assistance Program

POTENTIAL FOR DRY BULB ONION PRODUCTION IN NICARAGUA AND MARKETING OF DRY BULB ONIONS IN NICARAGUA AND CENTRAL AMERICA THROUGHOUT THE YEAR

Prepared by:
Shirley Kline

Submitted by:
Chemonics International Inc.

To:
**United States Agency for International Development
Managua, Nicaragua**
Under RAISE IQC Contract No. PCE-I-00-99-00003-00
Task Order No. 802
June 2000

Objective

The purpose of this consultancy was to evaluate various areas of Nicaragua for the production of dry (cured) white bulb onions with the ultimate goal of exporting these onions to El Salvador. Onion prices are very sensitive to the market forces of supply and demand. The time period of least supply of onions in Central America is essentially the ten months from mid - May through February. This also corresponds to the time when prices are higher.

El Salvador does not have the tradition of producing cured onions, although one project in 1994 produced cured white onions with the intention of exporting them to the U.S.. The onions were subsequently sold on the local market and were well accepted. The supermarkets, restaurants and hotels of El Salvador are accustomed to purchasing high quality dry white bulb onions, which are imported into the country. At the current time (late June – early July), good quality white onions are going into El Salvador from Mexico and poorer quality white onions are going into El Salvador from Guatemala. The problem with the Guatemalan onions at present is lack of sufficient curing. Since Salvador does not have the tradition of producing cured white bulb onions, the markets desiring these high quality bulbs must rely on imports throughout the year.

History of Onion Production

Certain regions of Nicaragua, i.e. The Valley of Sebaco, the area of La Concordia and San Rafael (Namanjí, Sacacolí, and Suní) and the area of Llano de Sabana Grande, San Gabriel and La Tejera in the Department of Jinotega, and the area of Llano Largo in the Dept. of Estelí have traditionally been onion production areas producing fresh (i.e., not cured) onions which are sold in bunches of 3 to 6 onions (with a portion of the leaves intact) per bunch depending on size of the bulb of the onion and the market where they are sold. The varieties traditionally used are a thick neck white onion called Sebaqueña grown in the Sebaco Valley as well as other production areas and La Criolla which seems to be better adapted to the areas of higher altitude than the Sebaco Valley. Both varieties produce a white bulb onion with a thick neck, which is well suited to tying in, bunches, but which does not dry well. For this reason these varieties are not appropriate for dry bulb onion production where a thin neck is desired. Both of these varieties are pungent and highly desired for cooking onions.

Export onion production began in the early 1990's when Asgrow convinced Sr. Samuel Mansell to plant an onion variety trial in one of his fields. When people working with the USAID PROEXAG EXITOS Project viewed the trial, the decision was made to promote onion production in Central America for export to the U.S. in late winter before the Rio Grande Valley and other onion production areas started harvesting. 1993, a year of high prices late in the identified market window for Central America, found a few containers exported to DeBruyn Produce and Georgia Vegetable. The high prices received and the success of the production increased interest in production of export onions and in 1994 a much greater area was planted to yellow onions for export.

At the same time, it was found that the Granex 33 (same variety used in Georgia) onion produced in the Sebaco Valley was mild (not pungent). Georgia had a reputation for producing a mild, sweet onion called the “Vidalia Sweet” and Georgia Vegetable was able to sell the Sebaco onions for \$4 –5 more per bag than the general onion marketer, DeBruyn. As a result of this experience, Mr. Samuel Mansell under the business name of MANPROSA signed an agreement with Georgia Vegetable to produce and sell the “Sebaco Sweet” onion. This was an exclusive agreement between the two parties that only the two could produce and market the “Sebaco Sweet”.

MANPROSA worked with other growers in the area who were willing to sell their sweet onions to MANPROSA, training them in how to produce the sweet onion. MANPROSA bought the onions and graded and packed them under the “Sebaco Sweet” label. Due to the success of the “Sebaco Sweet” onion, other U.S. buyers soon moved in wanting to buy sweet onions from the Sebaco Valley. Keystone Produce, of Philadelphia, PA started buying sweet onions and a couple years after the “Sebaco Sweet” gained notoriety, started marketing the “Maya Sweet” sometime around 1994 –1995. Keystone continues to buy sweet onions from AGRODESA and El Cacao and market them as “Maya Sweets”.

As a result of the successful production and marketing of yellow sweet onions, the production system for export onions has been widely adopted in the Sebaco Valley as well as a few other areas the consultant visited.

There have been shifts in the sweet onion market window over time from 1993 - 94 when sweet onion production first started in Central America and the present. Initially the market window extended from November through the early part of March. Now prices start dropping by the end of February so Nicaraguan producers look for a market window from late December to about the third week of February.

A major influence in the sweet onion market has been the South American countries of Peru and Ecuador. Since onion production in Peru and Ecuador occurs in an arid area under irrigated conditions, there aren't the problems caused by heavy rains or hurricanes, as is commonly the case in Central America. U.S. onion buyers have thus shifted their production emphasis from Central America to South America because of the reliability of the product. Over-production this year caused depressed prices for all and the Nicaraguan onion producers suffered from low prices and the need to sell onions on the local market. Because the market can only absorb a certain quantity of onions at any one time and the short day onion cannot be stored for any great length of time, postharvest losses were very high.

Production Constraints

The recommended method for producing dry bulb onions is to seed onions in a seedbed and allow them to grow for approximately six weeks. After six weeks in the seedbed, plants are pulled, graded for size (desired size is a little thinner than a lead pencil) and transplanted in the field. From the time of transplanting until harvest is approximately 90 days with the Granex 33 variety. Other short day varieties can require up to 110 days to mature at altitudes of 500 meters above sea level.

The onion plant signals its maturity by doubling the leaves at the neck of the onion. When approximately half of the field has doubled naturally, the rest are doubled either by hand or machine or they are undercut which breaks the contact between the roots and the soil. Onions are pulled and the leaves of one onion are arranged over the bulb of another onion to prevent sunburning of the onion bulb. Onions are left in the field in this manner for three days in the Sebaco Valley, then leaves are cut from the plant and the bulb is placed in a jute sack to cure for three more days. At that point the onion is ready to be taken to the packing shed to be graded and packed for market. The time from pulling the onion until it is packed into a container for export varies from 1.5 to 2.0 weeks or more depending on environmental conditions. Another week is required for international transport, inspection by customs and transport from the port of entry to Tifton, Georgia. Another day or two is required to go into the port at Philadelphia. With this time table of approximately 4.5 months from the time of placing the seed into the ground until the moment that the onion is in the U.S. or Canada at the market, means that a November market requires planting seedbeds in mid June to mid July, December requires a seedbed planted from mid July to mid August and January a seedbed planted from mid August to mid September.

Initiation of the bulbing process in the onion plant is caused by an interaction between daylength and temperature. When temperatures are warmer, fewer days with sufficient hours of light are required to initiate bulbing in the onion plant. Experience in Central America has shown that at approximately 500 meters above sea level short day onions will bulb prematurely if seeded before August 15. Lower altitudes will cause the initiation of the bulb sooner. Higher altitudes will delay the initiation of the bulb due to the lower average daily temperature. Altitude also affects the amount of time required between transplanting and harvest. The same variety, Granex 33, planted at different altitudes required the least amount of time (about 80 days) to mature at low altitudes (50 m above sea level) and the most amount of time (about 165 days) to mature at high altitudes (1500 m above sea level) in a study I did in Honduras in 1994.

There is also an effect from the variety planted. Some varieties bulb sooner than others. Bulbs formed prematurely in the life cycle of the plant do not have adequate size (bulbs ≥ 3.0 inches) for the U.S./Canadian export market. There has been some shift in the sweet onion market standards and onions with 2.875 inch diameter are widely accepted now. The physiological constraints of the short day sweet onion make it very difficult for Nicaragua to plant early enough for the November and December export market. Thus onion exportation is greatest in January and February in Nicaragua with a subsequent ample supply of onions for the local market that do not meet export standards.

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Onion production has traditionally been highest during the months of March and April in all of Central America. This production cycle fits best with the rainy and dry seasonal pattern. Historically, the rainiest months of the year are September and October. The traditional production cycle allows growers to avoid the riskiest time of the rainy season in September and October, when they are most likely to lose their onion seedbeds, but still allows them to take advantage of rains occurring in November and December. Due to market forces, Nicaraguan export onion producers have had to shift their production cycle to a time of year that exposes them to great financial risk as happened in 1998 when Hurricane Mitch destroyed export onion production.

Markets

Although March and April have traditionally been the months of greatest onion production in all of Central America, onions have been and are produced throughout the year. These onions are sold as fresh (not dry bulb) onions grouped in bunches of 3 to 6 onions per bunch depending on the size of the onion and the market where the onions will be sold. El Salvador and Nicaragua have traditionally produced a white onion while Honduras has traditionally produced a red onion for the fresh bunched onions. Production has not been sufficient to meet demand, however, and onions were traditionally imported from the U.S., Canada, México and other countries in the early to mid 1990's. Due to the perishable nature of the short day onion, shortages in national production usually were evident by mid to late May, a period that coincided well with the need to empty onion storages in the northern United States and Canada. These pungent storage onions were inexpensive to purchase because storage operators recognized the need to sell the onions immediately or dump them. Even with the cost of transportation, these onions could be sold at a good profit in Central America and the Caribbean. However the quality of the storage onion was variable. The onions were at the end of their storage life. Dormancy had broken in a good percentage of the onions so that they sprouted when exposed to ambient conditions in Central American markets. As exportation of high quality onions expanded with the demand for sweet onions, Central American markets became more accustomed to the quality that an export onion commands. No longer satisfied with the poor quality of the storage onion at the end of the storage period, markets opened for Mexican and Guatemalan onions during this period and the dumping of storage onions in May and June is not a significant factor anymore. However Canada and the U.S. continue to export significant quantities of onions into Nicaragua at the time that harvest of storage onions begins, that is, in August. Both countries continue to export onions into Nicaragua until January when there is sufficient domestic production of cured yellow onions.

Where onions come from at any given point in time is always fluid because of the constant influence of weather on production and the rapidly changing nature of prices. The market always seeks the best quality at the lowest price. The following information represents the importation of yellow bulb onions into Nicaragua during the year 1999.

Importation of Yellow Bulb Onions into Nicaragua Ranked by Country of Exportation

Country	% of Total	Number of Bags*	Period of Importation**
Canada	36.1%	112,842	August – January
Guatemala (Mexico?)	26.4%	82,288	June – July
Costa Rica	18.5%	57,904	June – July
U.S.A.	15.7%	48,937	August – January
Madagascar	1.4%	4,404	??
Colombia	1.1%	3,580	July – August
Chile	0.7%	2,214	July - August
Total	99.9%	312,169	

*Information provided by Centro de Exportaciones e Inversiones, converted to number of bags of 50 pounds/bag

** Information provided by Alejandro Mansell, MANPROSA

The consultant visited the wholesale market and several supermarkets in Managua on Saturday, June 24, 2000. At the wholesale market I found medium size dry yellow bulb onions of good quality which all vendors told me came from Guatemala. There is doubt expressed by Alejandro Mansell about whether all these onions are actually from Guatemala or whether some are passing through Guatemala from Mexico without going through customs.

In both the wholesale market in Managua and the supermarkets visited the consultant was told that public preference in general is for dry yellow bulb onions with a diameter no greater than 2.5 inches. The produce manager of La Colonia told me that he sells ten times as many dry yellow bulb onions as he does all other onions combined (dry red bulb onions, dry white bulb onions and fresh white bunched onions). Smaller diameter onions (.5 to 1.0 inches in diameter) are purchased by the poorer people and the larger diameter onions are purchased by people with more resources according to the sellers in the market. The white Sebaqueña type is preferred for making soup. White onions are purchased when prices are high for yellow onions, but the preference in Managua is definitely for cured yellow onions.

Price differences in La Colonia on June 24 were as follows:

Dry yellow bulb onions	3.60 Cordóbas per pound
Dry red bulb onions	4.25 Cordóbas per pound
Dry white bulb onions	3.25 Cordóbas per pound
Fresh white bunched onions	2.69 Cordóbas per bunch at a weight varying between .33 and .5 pounds per bunch of 3 onions.

People think the fresh white bunched onions are the cheapest, but on a per pound basis they are really the most expensive. This weight also includes the green leaves or stems as some people call them.

Conclusions regarding the market:

Obviously, there is a substantial market for cured dry yellow bulb onions throughout the year in Nicaragua that is not being filled by domestic production. Although this was not an expressed objective for my consultancy, it is an undeniable fact that should not be ignored.

There is also a market for dried white bulb onions in El Salvador with at least one buyer expressing a desire to import cured white onions twelve months of the year. The size of onion sought is a medium size, with a diameter between 1.75 and 2.5 inches. Smaller diameter onions have a market in the town markets and for the poorer class, but the price per hundredweight is less. The preference for white onions in comparison to yellow onions as described by Godofredo Pacheco, head of PROEXSAL, a marketing cooperative in El Salvador is as follows: 80% of onions sold in El Salvador are white while 20% are yellow. The price being paid for imported white cured onions in El Salvador at present (early July) is \$10.60 per fifty-pound bag or \$21.20/cwt. Sr. Pacheco indicated that he knows many buyers in the wholesale market (La Tiendona) in San Salvador who would also be interested in purchasing dry white bulb onions from Nicaragua.

In any export production system, there are always onions that cannot be exported due to price, size or quality. Knowing that there is a domestic market for these onions reduces the risk to the grower. It appears that when prices are low enough, some consumers will buy either white or yellow onions depending on which they perceive to be the better buy. The market, however, is accustomed to a dry yellow bulb onion and a white fresh bunched onion, not a dry white onion. There may be some consumer resistance to the dry white bulb onion, but there is certainly a market for the dry yellow bulb onion of any size except the extremely large diameter bulbs (>3.0 inches in diameter).

Production Areas

The consultant visited the following production areas in Nicaragua:

Sebaco Valley

This is the center of sweet onion production in Nicaragua where the export production system is widely used. It is well adapted to onion production and has the infrastructure for grading and packing onions. There are many sheds in the area, both tobacco curing sheds of wood and other sheds of brick and steel construction that could be used for curing onions. Protection from rain, installation of large (5 ft. diameter), high velocity fans, wooden floors or wooden bulk boxes to permit adequate air circulation around the bulbs are the changes that need to be made.

The area also has a marketing system in place that could quickly move either dry yellow or dry white onions domestically or internationally.

Since the area is relatively flat there is no way for large amounts of excess water to drain away during periods of heavy rainfall. For this reason, production should be avoided

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during the time of heaviest rainfall in the year, that is the months of September and October.

Miraflores

This is a protected area in the mountains where farmers are producing vegetable crops organically. One part has relatively low rainfall where another area I visited is cloud forest. The consultant observed cauliflower, broccoli, potatoes and zucchini in the field. Soil pH was low ranging from 5.6 to 6.2 in one field of broccoli in the cloud forest area of Las Mesas. In the drier zone, soil pH was 6.5 in a field of cauliflower.

Good access, good soils and irrigation make this an area with potential for organic production if a niche market can be identified that will guarantee a return on investment. Due to environmental concerns this cannot be considered as an area of commercial production where the usual array of pesticides and fertilizers are used.

Namanjí Sacací Suní

These three areas are traditional onion production areas for the white Sebaqueña type onion sold in bunches. Growers do not use raised beds but rather a depressed area where onions are transplanted and flood irrigated. Growers will need to change their production systems in order to produce quality dry bulb onions. Soil pH tended to be a little low (5.8 in one field). Soil sampling should be done. Fertilization and lime applications should be made on the basis of the results of the soil tests. Training in the use of the soil test results should be included in the technical assistance program.

This area will need at least one shed, high velocity fans, and an electrical generator to provide power for equipment to cure onions. Electrification is supposed to come to the area in a short period of time, but the back up generator will insure that power is available for curing onions at all times. Grading and packing can be done at APENN's Apanás facility.

Ocotal

Las Jaguas El Carrizal El Zapote Ciudad Antigua

There are six areas where the Asociación de Mujeres Desempleadas is working near Ocotal. We visited two areas: Las Jaguas and El Carrizal. Las Jaguas represents the better areas, meaning areas with less slope and better accessibility to transportation. The road going to El Carrizal is little more than a path and in one location we actually risked our lives trying to cross where the road had been eroded away on one side and a solid rock wall prevented moving any further from the eroded road edge. No buses go into the area and

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residents must walk out and walk back in to get the things they need but do not produce themselves. We were told that El Carrizal is typical of three of the areas AMDES works in and Las Jaguas represents the other three areas. Family size in El Carrizal is approximately 6 children and women head the households. It is a very poor area in real need of assistance but road conditions limiting access are a substantial drawback to working in the area. The technician working in the area often has to walk in because there is only one motorcycle for the whole group of technicians to use. The walk one-way is of 3 hours duration limiting the technician's actual work time in the area.

The soil pH in Las Jaguas was 6.2 – 6.4 which is adequate for onion production. Soil pH in El Carrizal ranged from 6.8 at the lowest elevation to 7.8 at the highest elevation where there was very little topsoil.

Neither the women providing technical assistance nor the women who plan to grow onions have any experience producing onions. They have no tools, no money for seed or any other inputs. While this project is certainly in need of financial aid and technical assistance, it does not represent an area of commercial potential. AMDES and its cooperators are planning to produce vegetables organically. If a market niche is identified in Nicaragua for organic onions and if transportation, financing and technical assistance can be arranged, ARAP may be able to work with this group in the area of Las Jaguas, El Zapote and Ciudad Antigua. The other three areas should not be used for cultivation of annual crops. With the slope and the thin layer of top soil, the area of El Carrizal and the others like it should be used for reforestation and planting of perennial crops such as coffee, not for production of corn, beans, onions, tomatoes, cabbage, or garlic. The concept of organic production which promotes a sustainable agricultural system does not encourage the use of steep slopes such as are found in El Carrizal. AMDES is working with the women to construct terraces for annual crop production, which is much, more desirable than planting on slopes as can be seen throughout the area. With the poor road conditions, transporting perishable vegetables is nearly impossible.

Department of Jinotega Llano de Sabana Grande, San Gabriel, & La Tejera

These traditional onion production areas have access to water for irrigation and use raised beds to produce onions. The soils in San Gabriel are a little heavier than that in Llano de Sabana Grande and do not produce as well. Soil pH in San Gabriel ranged between 6.4 and 6.6 which is excellent for onion production. This area has potential for export onion production with the addition of sheds and high velocity fans where onions can be cured under adverse conditions. Cured onions can be transported to APENN's Apanás facility for grading and packing.

La Tejería

This is a high, dry area where onions are produced in the rainy season without irrigation. There are no wells or rivers for obtaining water. If the rains do not come, the growers lose their plantings or do not plant at all. Interestingly, the onions observed in La Tejera were being grown on raised beds in spite of the fact that no irrigation was available.

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The type of onion produced is the white bunching onion. It is an area of high risk and is not recommended for dependable export production.

Department of Estelí
Llano Largo

This traditional onion production area has reservoirs where rainwater can be stored and used for irrigation. There is a system in place that collects rainwater, pumps the water from the reservoir by wind power (windmill) into a tank where the water can be chlorinated and then pumped out to surrounding homes to provide potable water to residents.

It is an area of considerable risk. If the rains do not come and fill the storage reservoirs, onion production is not possible. However the reservoirs make onion production possible in good years. Road access is adequate to transport onions for grading and packing, but a system for curing with a portable generator is required for curing during the rainy season. Cured onions could be transported to APENN's packing shed in Sebaco or there may be other packers who would be interested in grading, packing and selling these onions.

Visit to APENN's Packing Facility at Apanás

This facility was visited with the objective of viewing the facility for its appropriateness for onion grading and packing. While there is insufficient space at the present time for an onion grader, APENN owns enough land so an additional packing area could be added. The manager of the facility indicated that APENN is interested in packing additional vegetables (besides the tomatoes, peppers, beets, etc. packed now) and would be agreeable to building additional packing area and obtaining an onion grader. MANPROSA indicated they have an onion grader for sale and I know there are two onion graders for sale in Honduras, one in Comayagua and one in Olancho. Thus an onion grader could be obtained either in country or in Central America. The Apanás facility has a loading dock, pallet jack and an area where packed product can be stored prior to loading a truck.

Visit to Potato Storage Shed in El Tisey

I visited a huge potato storage facility built during the time the Sandinistas were in power by the Dutch government. The storage has scales for weighing trucks in and out to determine weight of load transported, equipment for moving product within the storage, excellent grading and packing equipment, and an individually controlled ventilation system for the separate storage areas. It is close to being state of the art and certainly was at the time it was constructed. I was told that all equipment is functional and the only damage that has occurred is the missing roof destroyed by Hurricane Mitch.

Storage conditions for potatoes require a high relative humidity and cold temperatures. Storage conditions for onions require a low relative humidity and cold temperatures. Airflow adequate for potato storage is inadequate for onion storage because the system is designed to minimize water loss from the potato. The ventilation system

consists of ducts in the floor which moves air up through the potato pile. Therefore additional ventilation would be required to adapt the storage for onions.

Storage of short day onions for an extended period of time (more than one month maximum) is not recommended because of the short period of dormancy, high water content of the onion, and general lack of sulfur compounds which give the onion its pungency but which also protects the onion by the anti-microbial action of the sulfur compounds.

The facility is grossly overbuilt, but an excellent facility. However I fail to see how its use fits into the scheme of production and marketing as proposed in this report. The facility is out of the way, on a bumpy dirt road, distant from the onion production areas and the grading and packing facilities. I feel a plan to produce a constant supply of recently harvested and cured onions is much preferred to an oversupply at any one point in time which necessitates storage of the overproduction. Planning to store short day onions and market them over an extended period of time will result in lower quality product with significant losses.

Conclusions

The area of yellow bulb onion production in Guatemala during the period from May until August is in Huehuetenango which has an altitude of about 1300 meters above sea level with an annual rainfall of 1400 ml.. While there is no area I visited that has as high an altitude, rainfall patterns are less than or similar to Huehuetenango in the higher altitude areas of production in Nicaragua. The constraining factor is not whether onions can be produced but rather which varieties will perform best for specific harvest periods from June until December. A knowledge of how various varieties of white and yellow intermediate day and short day onions perform in the different onion production areas in Nicaragua from June through December is required. This can be accomplished with field trials in farmers' fields and in APENN's model farms starting as soon as possible. These do not need to be rigorous scientific trials, but they do need to be conducted using the recommended export onion production system of raised beds. Measuring yield and looking at disease resistance and quality of the bulb produced should be the parameters measured in the trials.

Onions can be cured in the tropics even during the rainiest part of the year if certain conditions are met. Once the onion is harvested, it must be protected from mists and rain. Onions can be cured by using large five-foot diameter, high velocity fans to circulate air throughout the onions. Although heated air speeds the curing process, it is not required. Only a constant airflow of high velocity is required to carry off existing moisture in the onions. Onions can be placed in bulk pallet boxes of wood or placed on a wooden floor with some air space below. Placing onions directly on concrete floors is not recommended because of the moisture retaining characteristic of concrete and the risk of flooding at ground level during periods of high rainfall as well as the inability to get good air circulation around the onions lying directly on the floor.

In the Sebaco Valley, there are many “galeras” or warehouses where onions could be cured with a relatively small investment. The other onion production areas I visited lacked the “galeras” or warehouses required to cure onions under rainy conditions.

Under no condition is refrigerated storage of short day onions for an extended period recommended. The cost of building and running a refrigerated storage is very high. Short day onions have a dormancy of only about one month. After one month of storage the onions start to sprout upon removal from refrigeration. Due to the high water content, lack of sulfur compounds that are antimicrobial in their effect, and high respiration rate, short day onions rot easily. Losses of short day onions even under good management and refrigeration are high in comparison with long day onions.

The Vidalia production area of Georgia uses modified atmosphere storages to extend their marketing period. Under these conditions the carbon dioxide content of the air is increased and the oxygen content decreased. This requires an airtight building and a very high level of technical skill to maintain. It is costly and is not recommended for Nicaragua. The Vidalia onion has a reputation in the market place which can command an adequate return for the investment in storage. Yellow onions produced in Nicaragua could not guarantee such a return and the risk to storage owners is unacceptably high in my opinion.

Thus the most sensible method of meeting market demand is to promote a stable supply of locally produced onions throughout the year that are cured and then marketed within three weeks of harvest. This is as true for the white dry bulb onion as for the yellow dry bulb onion.

Recommendations

1. Conduct variety trials of intermediate and short day, yellow and white onions in growers' fields, planting monthly for harvest in June through December. Trials of the same varieties should be conducted in each of the traditional production areas to determine adaptability for the zone of production and the time of year of planting.
2. Provide training in export production systems (raised beds) for technicians working in the areas of traditional production (TechnoServe, AMDES, UCA Miraflores) and assist these technicians with training sessions for growers in each production area covering the following subjects:
 - a. Taking a representative soil sample for analysis and using the results for determining fertilizer and lime requirements for the crop for either conventional or organic production systems. An analysis of the compost will be required for determining crop requirements in the organic production systems in each area.
 - b. Preparation and disinfestations of soils prior to planting a seedbed using either Basamid/Dazomet or soil solarization using clear plastic on humid soil for a period of 6 to 8 weeks prior to planting.

- c. Training in the export onion production system in areas where it currently isn't used.
 - d. Training in integrated pest management (Manejo Integrado de Plagas) including training in monitoring populations, understanding and using economic thresholds and methods of control, both conventional and organic.
 - e. Training in disease prevention and control.
 - f. Training in weed control using stale seedbed technique and mulch for organic systems and looking at low concentrations of Goal in conventional systems.
 - g. Training in harvesting and curing onions under high humidity or rainy conditions.
 - h. Perhaps, training in grading onions for those producing organic onions and grading with manual graders.
- 3. Encourage the planting of neem trees on all farms producing export onions and provide training on the preparation and use of neem for controlling insect pests.
 - 4. Provide training on U.S.E.P.A. approved pesticides (those with residues). Discourage the use of Furadan and Counter for "disinfecting" seedbeds, a practice which only controls insects, not weeds or diseases (a fact I found growers did not understand) and presents health hazards to applicators and consumers.
 - 5. Contract with Dr. Alfredo Rueda, Programa de Manejo Integrado de Plagas, Escuela Agricola Panamericano, Zamorano, Honduras, to conduct training sessions for technicians on how to monitor Thrips and Spodoptera populations, what an economic threshold is and what levels are indicated for populations of Thrips and Spodoptera in onions.
 - 6. Provide technical assistance and training in the use of simple, low cost drip irrigation systems for smallholders and/or areas where water for irrigation is very limited.
 - 7. Provide technical assistance for the installation of curing sheds with large (5 ft. diameter) high velocity fans. Prepare a budget determining cost of installation and cost of running.